Open Access
J. Glob. Innov. Agric. Sci., 2024, 12(1):251-254
ISSN (Online): 2788-4546; ISSN (Print):2788-4538
DOI: https://doi.org/10.22194/JGIAS/23.1078
http://www.jgiass.com

Comparison of toxicity of some synthetic insecticides against thrips (*Thrips tabaci*) on cotton crop under different irrigation regimes

Qurban Ali[1], Humair Amin[2], Bushra Akhtar[3], Irfan Ashraf[4,*], Mubashar Nadeem[5], Rao Sabir Sattar[6], Muhammad Hammad Raza[7], Kenwal Asghar[8], Saif Ali[6], Nazar Hussain Khan[9] and Habib ur rehman[,10,*]

[1]Entomological Research Institute, Ayub Agricultural Research Institute, Faisalabad, Punjab, Pakistan; [2]Department of Sociology and Criminology, University of Sargodha, Pakistan;[3]Center for Research in Molecular Medicine (CRiMM), Institute of Molecular Biology and Biotechnology (IMBB), The University of Lahore, Lahore 54590, Pakistan;[4]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan; [5]Department of Agronomy, Ghazi University DG Khan;[6]Institute of Agricultural Extension, Education and Rural Development, University of Agriculture Faisalabad, Pakistan; [7]Department of Agricultural Extension and Education, Ghazi University Dera Ghazi Khan, Pakistan; [8]Department of Rural Sociology, University of Agriculture Faisalabad, Pakistan;[9]Professional Training and Skill Development Center, University of Agriculture Faisalabad, Pakistan;[10]Water Management Research Farm, Renala Khurd, Okara, Pakistan.

*Corresponding author's e-mail:habib.ento@gmail.com; irfanflorist199@yahoo.com

Cotton is the main cash crop and back bone of agriculture. However, its yield is decreasing due to insect pests attack. Among them, sucking insect pests are serious problem in cotton and various agricultural crops. Hence, present research work was executed to assess the toxicity of some synthetic insecticides against *Thrips tabaci* in cotton crop. The research trial was executed with varied planting geometry under different irrigation regimes. Sowing of the cotton crop was done with plant to plant distance of 30 and 60 cm while row to row distance was 4 ft. apart. The plants were irrigated under single lateral and double lateral arrangements of drip irrigation while control plot was irrigated through conventional surface irrigation method. Results of relative incidence of thrips population on different irrigation plots showed that highest thrips population (19.43/plant) was noted in case of flood irrigated plot having plant to plant distance of 30 cm followed by in double lateral drip irrigation plot (15/plant) and single lateral plot (13.10 thrips/plant). Comparatively lower mean thrips population values; 16.30, 12.40 and 10.56 thrips/plant, respectively were recorded in experimental plot under 60 cm plant to plant distance. Toxicity bioassays revealed that highest reduction (75.27%) was recorded in spinetoram while lowest thrips population reduction (28.18%) was recorded in case of spinosad. It can be concluded that spinetoram can be effective tool for efficient control of thrips leading to augmentation in cotton crop yield.

Keywords: Population, insecticides, incidence, irrigation, crop produce, Comparison, Toxicity, Synthetic insecticides, Thrips (Thrips tabaci), Cotton crop, Irrigation regimes, Insecticide effectiveness, Pest control, Crop protection, Integrated pest management.

INTRODUCTION

Control is one of the main cash crop in Pakistan and worldwide. It contributes to textile industry to a large extent (Riaz *et al*., 2023). However, yield of cotton crop is being hampered by many biotic and abiotic factors. Among the biotic factors, insect pest infestations are of serious concern (Ali *et al*., 2019). The presence of insect pests and ailments is the central influence restraining the cotton production on sustainable basis. Cotton crop is being attacked by a variety of sucking and chewing insect pests (Conzemius *et al*., 2023). Sucking pests are the main problem as these insects attack the cotton crop at early stage and result in disturbs the normal biological process in the crop (Gassmann and Reisig, 2023). Among the sucking insect pests, thrips, *Thrips tabaci* (Thysanoptera: Thripidae), is the utmost harmful insect pests

Ali, Q., H. Amin, B. Akhtar, I. Ashraf, M. Nadeem, R.S. Sattar, M.H. Raza, K. Asghar, S. Ali, N. Hussain Khan and Habib ur rehman. 2023. Comparison of toxicity of some synthetic insecticides against thrips (*Thrips tabaci*) on cotton crop under different irrigation regimes. Journal of Global Innovations in Agricultural Sciences 12:251-254.
[Received 17 Jun 2023; Accepted 4 Sep 2023; Published 16 Mar 2024]

of cotton and other agricultural crops. Thrips are polyphagous insect pests and found on a variety of agricultural crops. Both adult and young ones of the insect pest wish to nourish on small and soft leaves (Shera *et al*., 2020). As a result of the insect feeding, silvery parts on leaves appeared. The infested plant leaves becomes twisted, crumpled and progressively dry up. Under severe infestations the cotton flowers drop down resulting in failure of boll formation (Srivastava *et al*., 2023). Use of insecticides is the main strategy for the control of thrips, nevertheless this approach is insufficient and unmaintainable (Potin *et al*., 2023) as the recurrent use of the insecticides against have produced resistance in thrips to numerous classes of insecticides (Srivastava *et al*., 2023). Conventionally, aerial sprays with neonicotinoid, pyrethroids and organophosphates insecticides have been practiced for thrips control in corn crop (Nazemi *et al*., 2016). The problem of resistance development in the insect pest has led the farmers to find alternate insecticides which could control this insect pest. Use of spinetporam was found effective against Thrips (Moretti *et al*., 2019). Seed treatment with Imidacloprid, Clothianidin and Thiamethoxam found effective against thrips in cotton crop (Ding *et al*., 2023). Nevertheless, thrips are small insects to be effortlessly recognized and are typically not unswervingly exposed to arial application of insecticides, as they are frequently present on internal leaves. Now-a-day, neonicotinoid seed treatments are extensively practiced as a part of insect control programs as they possess no residual effects and are environmentally safe. Neonicotinoid have been found effective against aphids (Zhang *et al*. 2016)

As only a few registered insecticides have ensured the operative and reliable control of this famous pest if applied with full care and at the suitable periods. Hence, the current research was planned to assess the effectiveness of some newer insecticides for the management of cotton thrips under field situations.

MATERIALS AND METHODS

Study site: The experiment was executed to evaluate different insecticides for the control of thrips on onions was carried out at two sites: During Kharif season 2021-22 in Gujranwala Division in 2015-16. The distance between the sites in each year was not less than 30 km. The experiment was followed by Randomized Complete Block Design (RCBD) with six treatments and three repeats at both sites.

Table 1. Description of treatments.

Sr. No.	Treatments	Active ingredient
1	Radiant	Spinetoram
2	Tracer	Spinosad
3	Pirate	Chlorfenapyr
4	Confidor	Imidachloprid

The insecticides were applied through Knapsack sprayer. All other standard agronomic practices except the application of the insecticides to be assessed were ensured to raise health cotton crop. The plot size for every treatment was 12x6 m. Sowing of cotton was done on 06 June, 2022 with plant to plant distances 30 and 40 cm. Irrigation was done through drip irrigation as well as conventional irrigation as control. The ridges were 4 (ft.) apart having 2 rows of cotton plants on the beds.

***Data collection*:** Data of thrips population before insecticide application was recorded and population data of cotton thrips were noted at even intervals from 5 arbitrarily chosen cotton plants in every rreplication and population counts of thrips present in every treatment were counted on visual basis and transferred into mean values of the thrips population for every replication. The thrips population was observed before application of treatments, followed by intervals of 24, 48 and 72 h after spraying (Din *et al*., 2016).

Mean (%) reduction in plant infestation was computed by following formula;

$$\text{Reduction in insect infestation (\%)} = \frac{P_1 - P_{2\ldots.P_5}}{P_1} \times 100$$

***Statistical analysis*:** The data were analyzed using "Statistics" software. The significant differences among means were compared using the LSD at α=5%.

RESULTS

Results (Fig. 1) revealed that maximum thrips population (19.43/plant) was noted in case of flood irrigated plot having plant to plant distance of 30 cm followed by in double lateral drip irrigation plot (15/plant) and single lateral plot (13.10 thrips/plant). Comparatively lower mean thrips population values; 16.30, 12.40 and 10.56 thrips/plant, respectively were recorded in experimental plot under 60 cm plant to plant distance. Furthermore, it was also noted that single lateral experienced comparatively less thrips population as compared to double lateral arrangement of drip irrigation system.

Outcomes (Fig. 2) showed that impact of treatments (insecticides) regarding reduction in mean thrips population was statistically significant ($p<0.05$). Maximum reduction (75.27%) was recorded in spinetoram treated plots followed imdiachloprid (71.56%), chloprfenpyre (54.89%) and spinosad (43.60%) after exposure period of 72 h. After exposure period of 48 h. the values were 63.16, 56.36, 45.10 and 36.90%, respectively. Lowest thrips population reduction (28.18%) was recorded in case of spinosad.

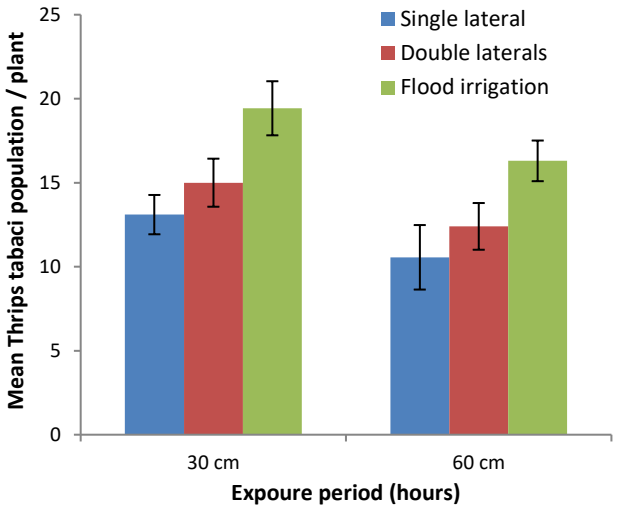

Figure 1. Relative incidence of cotton thrips population on experimental plots under different irrigation regimes.

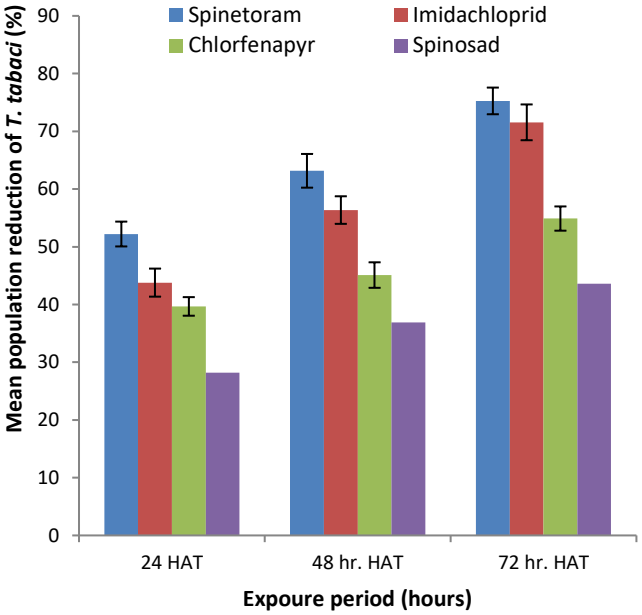

Figure 2. Mean population reduction of thrips in different treated experimental plots.

Data (Table 2) showed that maximum thrips population (19.40%) was observed at 42.2 ºC at 65.6% relatively humidity while lowest population (6.12%) was observed at 38.3 ºC.

Table 2. Mean seasonal occurrence data of *C. partellus* population dynamics in the kharif period.

Date	Mean insect population (%)	Climatological data	
		Mean temperature (ºC)	Relative humidity (%)
21-6-2022	6.12	38.3	58.2
28-6-2022	11.21	42.1	61.4
05-7-2022	18.12	41.3	64.1
12-7-2022	19.40	42.2	65.6
17-7-2022	15.26	34.4	51.4
24-7-2020	16.89	35.0	52.4
01-8-2020	17.54	34.2	49.1
08-8-2020	12.57	37.1	51.2
15-8-2020	9.76	36.2	50.1
22-8-2020	8.43	37.0	47.2

DISCUSSION

Results of insect population in different experimental plots revealed that maximum thrips population (19.43/plant) was noted in case of flood irrigated plot having plant to plant distance of 30 cm. Comparatively lower mean thrips population values were recorded in experimental plot under 60 cm plant to plant distance. Single lateral experienced comparatively less thrips population as compared to double lateral arrangement of drip irrigation system. Highest reduction (75.27%) was recorded in spinetoram treated plots while lowest thrips population reduction (28.18%) was recorded in case of spinosad. Climatology data showed that maximum thrips population (19.40%) was observed at 42.2 ºC at 65.6% during the month of July while relatively humidity while lowest population (6.12%) was observed at 38.3 ºC during the month of June. Outcomes of my research work were supported by research results of Hussein *et al.* (2015), who found that spinetoram 120 SC and carbosulfan 20EC abriged the thrips population density attacking the garlic plants and gave the maximum yield. The findings of our research trial were in line with Ibrahim *et al.* (2015) who noted remarkable variation in thrips population in experimental plots treated with spinetoram. Hussein *et al.* (2015) who attained the maximum garlic yield owing to less attacked of thrips by application of spinetoram 120SC. In our research work, we also recorded maximum reduction in thrips population in spinetoram treated plots which confirmed the results.

Conclusion: From the results, it can be concluded that spinetoram resulted in maximum reduction thrips population and can be a best candidate for IPM of the thrips control leading to maximization of cotton crop. Imidachloprind was the next effective one in reducing the thrips population. Hence, both insecticides can be used in combinations for effective control of thrips.

***Authors' contributions*:** QA and HR Conceived the idea, HA, HR and BA wrote the manuscript, IA, MN, NHK and RSS reviewed it, MHR, NK, KA and SA analyzed the data

***Funding*: No**

***Ethical statement*:** The authors declare that there is no conflict of interest.

***Availability of data and material*:** Data will be available on reliastic request at any time

***Acknowledgement*:** The authors thank and appreciate the respondents for their cooperation during the data collection.

Code Availability*: *NA

***Consent to participate*:**All authors agreed.

REFERENCES

Ali, M.A., J. Farooq, A. Batool, A. Zahoor, F. Azeem, A. Mahmood and K. Jabran. 2019. Cotton production in Pakistan. Cotton Production 249-276.

Ali, S.S. and A.E. Khalil. 2022. Comparative study of the efficacy between some formulations of entomopathogenic fungi with botanical and chemical pesticides against onion thrips, *Thrips tabaci* Lind. Egypt. Acad. J. Biol. Sci. Part F :221-228.

Ashghar M, Baig MMQ, Afzal M and Faisal N, Evaluation of different insecticides for the management of onion thrips (*Thrips tabaci* Lindeman, 1889) (Thysanoptera, Thripidae) on onion (*Allium cepa* L.) crops. Pol. Journal Entomol 87:165.

Conzemius, S.R., F.P. Reay-Jones, J.K. Greene, B.T. Campbell, D.D. Reisig, H. Wang and W.C. Bridges. 2023. Field screening of wild cotton, *Gossypium hirsutum*, landraces for resistance to thrips (Thysanoptera: Thripidae). Crop Prot 163:106113.

Din, N., M. Ashraf and S. Hussain. 2016. Effect of different non-chemical and chemical measures against onion thrips. Journal Entomol. Zool. Stud 4:10-12.

Fu, B.L., L.D. Tang, H.Y. Qiu, J.F. Liu, D.Q. Zeng and Y.X. Xie. 2016. Screening of high effect and low toxicity insecticides for controlling *Thrips hawaiiensis* (Morgan). Chin Journal Fruit Science 33:257-267.

Gassmann, A.J. and D.D. Reisig. 2023. Management of insect pests with Bt crops in the United States. Ann. Rev. Entomol 68:31-49.

Gulzar, S., W. Wakil and D.I. Shapiro-Ilan. 2021. Potential use of entomopathogenic nematodes against the soil dwelling stages of onion thrips, *Thrips tabaci* Lindeman: laboratory, greenhouse and field trials. Biol. Control 161:104677.

Iglesias, L., M.J. Havey and B.A. Nault. 2021. Management of onion thrips (*Thrips tabaci*) in organic onion production using multiple IPM tactics. Insects 12: 207.

Moretti, E.A., R.S. Harding, S.G. Scott and B.A. Nault. 2019. Monitoring onion thrips (Thysanoptera: Thripidae) susceptibility to spinetoram in New York onion fields. J. Econ. Entomol. 112:1493-1497.

Nazemi, A., J. Khajehali and T. Leeuwen. 2016. Incidence and characterization of resistance to pyrethroid and organophosphorus insecticides in *Thrips tabaci* (Thysanoptera: Thripidae) in onion fields in Isfahan, Iran. Pesticide biochemistry and physiology 129:28-35.

Potin, D.M., A.V. Machado, J.H. Delabie, I.C. Martins, M.E. Whitehouse and J.B. Torres. 2023. Response of foliage- and ground-dwelling arthropods to insecticide application: early step for cotton IPM in the Brazilian semiarid. Agric. Ecosyst. Environ 344:108308.

Riaz, A., F. Ullah, S. Chohan, A. Saeed, M. Aqeel, A. Sher,... and M. Khalid. 2023. Estimation of Heterosis and combining ability effects for yield and fiber quality traits in cotton (*Gossypium hirsutu*m l.). Biol. Clinic. Science Research Journal 1:261-261.

Shera, P.S., V. Kumar and V. Jindal. 2020. Sucking Pests of Cotton. In: Omkar (eds.) Sucking Pests of Crops. Springer, Singapore.

Srivastava, A., G. Jain, S. Chandra, V. Kalia, S.K. Upadhyay, R.S. Dubey and P.C. Verma. 2023. Failure of methanol detoxification in pests confers broad spectrum insect resistance in PME overexpressing transgenic cotton. Plant Sciences 333:111737.

Yannuzzi, I.M., E.A. Moretti and B.A. Nault. 2021. Comparison of bioassays used to determine onion thrips (Thysanoptera: Thripidae) susceptibility to spinetoram. Journal Econ. Entomol. 114:2236-2240.

Zhang, P., X. Zhang, Y. Zhao, Y. Wei, W. Mu, and F. Liu. 2016a. Effects of imidacloprid and clothianidin seed treatments on wheat aphids and their natural enemies on winter wheat. Pest Manag. Sciences 72:1141-1149.